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Policy Distortions in the Segmented Rice Market

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ABSTRACT

High production and export subsidies in developed countries and high protection in both developed and developing countries have distorted rice trade. This study estimates the impact of rice policy distortions on developing countries' rice production and trade potential. Because rice markets are highly segmented, major rice types are differentiated to estimate the impact of current and likely policy reforms. Analysis in long-grain, high-quality rice focuses on rice import and export markets in Latin America and shows that reduction of direct and implicit export subsidies in the US will benefit regional suppliers such as Argentina and Uruguay. Analysis of Indonesia's import market of ordinary long-grain rice, where protection is high, reveals that tariff hikes in this large importing country are in part a response to increased support from the exporting side. Level of domestic stocks also determines tariff movements. In the short/medium grain rice market, this study focuses on the highly supported and protected rice market in Japan and find that only aggressive rates of increase in import tariff-rate quota and reduction in production subsidies would have significant impact on import volume and price. Prices and trade would also be affected by a reduction of the high over-quota tariff.

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POLICY DISTORTIONS IN THE SEGMENTED RICE MARKET

Manitra A. Rakotoarisoa[1]

1. INTRODUCTION

For many developing countries, rice is the main staple and one of the most important sources of agricultural revenue at the farm and country levels. One of the main problems that the rice sector in developing countries faces today is the lack of market opportunities at both local and international levels. The lack of market opportunities translates especially into losses in income opportunities for small-scale rice producers, who are among the world's poorest farmers.

The rice production and trade policies in both developed and developing countries have shaped the structure of rice trade. Rice market is thin as trade volume represented only 7% of rice consumption for the period 2000-2003 (FAO, 2005). But the thinness of rice trade differs from its level of policy distortion, which is among the highest in agricultural commodity markets. For instance, during 2002-2003, OECD rice producers received 22 billion USD of support per year, which is 11 % of total OECD agricultural support (OECD, 2005). Such a high level of support reflects high implicit and direct export subsidies distorting rice trade, i.e., forcing rice to flow from high cost to low cost countries. In contrast, rice farming and exports in developing countries, until recently, was severely taxed to protect consumers. Moreover, high levels of import protection remain in large markets of both developed and developing countries.

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Though reforms in the global rice market, since the start of the Uruguay Round, have focused on removing distortions, the pace of reform has been slow. Past studies have shown the positive impact that reforms would produce on global welfare. Nevertheless, they fall short in fully explaining the link between policy distortions and the problems facing rice sectors nowadays for two main reasons. First, rice market is highly segmented, but past studies often used aggregated data thus, drawing rather vague policy implications and recommendations for specific countries or specific rice types. But, specific recommendations are needed to ensure the effectiveness of policies aimed at removing distortions in the rice trade and increasing welfare in many countries, especially developing countries that mostly produce or consume only one specific type of rice. Second, interaction in rice policies between trading partners at the regional level remains unexplored. Identifying these policy interactions, at least at the regional level, is needed to determine the sources and impact of distortions and to advance negotiations aimed at removing these distortions. This study intends to address these needs.

The main objective of this paper is to estimate the impact of rice policy distortions in both developed and developing countries, on developing countries' rice production and trade potential between 1961 and 2002. This paper is divided into four sections including this introduction. Section 2 describes rice market structure and reviews rice policies in selected developed and developing countries. Section 3 analyzes the impact of policy distortions. In contrast to other studies, it differentiates between major rice markets since trading partners and levels of distortion differ depending on the quality, form, and varieties of rice. Specifically, the study examines (i) the effects of reduction of actual

and implicit export subsidies from developed countries for high quality grain rice markets; (ii) the effects of the combination of and interaction between tariff reduction in importing countries and reduction of actual and implicit export subsidies for low quality grain rice; and (iii) and the effects of the combination of an increase in minimum access and tariff reduction in the importing side for short/medium grain market. Section 4 concludes the study and draws policy implications.

2. RICE MARKET SEGMENTATION AND POLICIES

2.1 RICE MARKET SEGMENTATION

Rice trade in the international market remains thin although rice trade volume as a percentage of production rose from 5% to 7 % between the periods of 1990-1999 and 2000-2003.[2] Rice market is also segmented into different categories, essentially by variety, degree of processing, grain quality, and sources (USDA, FAO). There is little substitution in consumption and production among countries.

By variety: There are two major varieties of rice: *indica*, long grain rice, grown specifically in tropical regions, and Japonica (medium grain rice), grown under a much cooler climate. A distinction is often made within each of these major varieties to add into the classification the aromatic long grain rice and the glutinous (short or medium sticky) rice. During 2001-2003, the variety i*ndica* represented 75 % of global trade; *japonica,* 12%; aromatic rice such as *basmati* from India and Pakistan, and *jasmine* from Thailand (10%); and (iv) glutinous (or sticky) rice (3%). There are several types of rice under each of these major varieties.

By degree of processing: There are mainly four main categories: paddy (rough), husked (brown), milled (white), and parboiled. Milled rice has dominated global rice trade and represented 77 % of the volume share during 2001-2003. However, trade in parboiled rice has increased over the years and reached 15 % of the total rice trade during

[2] Between 1997 and 2002, rice trade is only 6.5 % of world consumption (USDA).

2001-2003. Paddy and brown rice trade represented smaller shares at only about 4%each.

By quality of milled grain: The classification is based on the percentage of broken grain. Trade in high quality milled rice has slightly increased during the last eight years. High quality rice, with less than 20 % of broken grains represents three-fourth of the global trade during 2001-2003.

By source: Some appellations are specific to the region or country of origin. For instance, the different varieties of basmati rice are specific to India and Pakistan. Also, for the same variety, form, and quality of rice, some consumers often view domestically produced rice as always different from imported rice.

2.2 DETERMINANTS OF RICE POLICIES

Rice is a major staple for several billion people in many countries; Table 1 gives an overview of rice production and trade for major rice countries. Rice policies, however, have been based on protecting some social groups at the expense of others. Rich rice countries often protect their producers and exporters while poor rice countries protect mostly their consumers. For rich rice countries, maintaining rice tradition and securing large profits for rice farmers and millers have been the main reasons for producer support. For developing countries, food security concerns, especially the desire to provide cheaper rice to urban or non-farming consumers, which often have more political power, have been the reasons for taxing rice farming. These strategies have caused distortions in prices and resource allocation and in trade pattern.

Table 1—Rice production and trade in selected countries, 2002

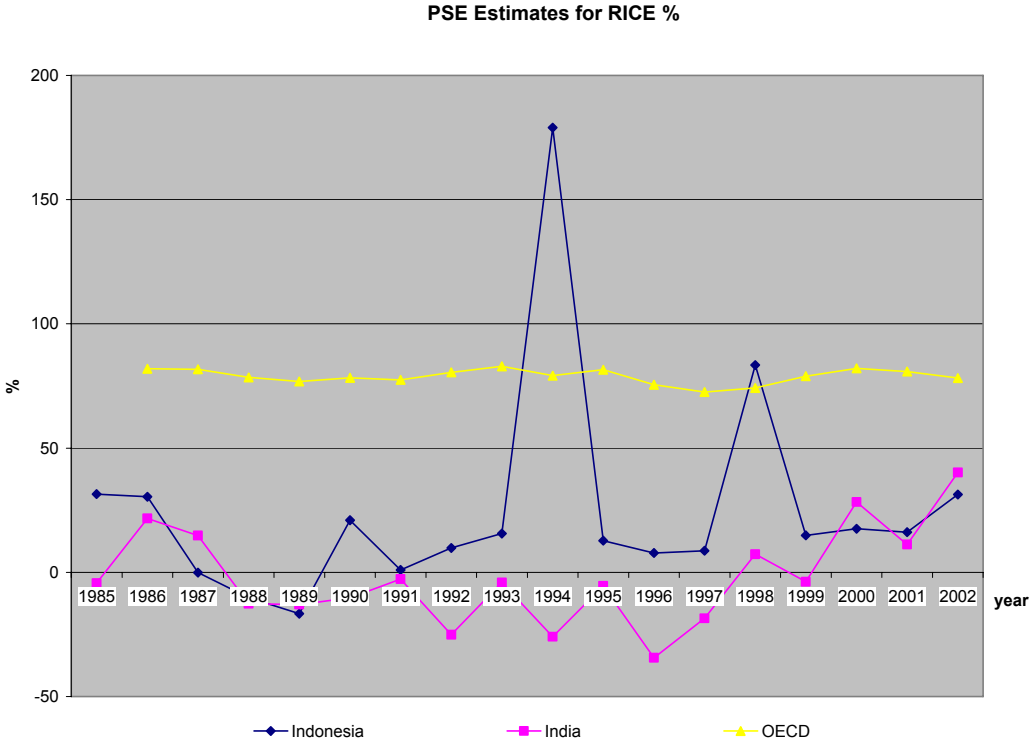
Country	Yields Paddy Rice (MT/ha)	Paddy production (MT)	Milled rice Net Export (MT)	Agricultural value-added per worker* (USD 1995 constant)
1. Argentina	5.746	713,449	220,745	10,374.550
2. Australia	8.607	1291,000	268,540	36,865.740
3. Bangladesh	3.423	3,7851,000	-942,872	322.218
4. Brazil	3.324	10,457,100	-531,998	5,086.847
5. Cambodia	1.916	13,822,509	-17,227	421.817
6. China	6.186	176,342,195	1,728,144	342.496
7. Colombia	5.011	2,346,940	-62,355	3,636.244
8. Egypt	9.141	5,600,000	463,021	1,331.858
9. Guinea	1.613	845,000	-331,975	293.3051
10. Guyana	3.825	443,700	174,247	4,267.472
11. India	2.683	107,600,096	5,052,370	411.093
12. Indonesia	4.469	51,489,696	-1,967,717	749.192
13. Iran	4.727	2,888,000	-868,789	3,790.597
14. Italy	6.270	1,371,100	504,619	27,654.190
15. Japan	6.582	11,111,000	-626,902	34,140.070
16. Korea	6.350	6,687,225	-151,299	14,743.210
17. Laos	3.086	2,416,500	-26,400	624.339
18. Madagascar	2.141	2,603,965	-61,082	156.128
19. Malaysia	3.090	2,091,000	-518,205	6,929.884
20. Mali	1.971	710,446	-10,076	286.595
21. Myanmar	3.674	22,780,000	723,744	n.a.
22. Nepal	2.675	4,132,600	-14,636	206.351
23. Nigeria	1.024	3,192,000	-1,199,637	742.223
24. Pakistan	3.018	6,717,750	1,670,491	698.227
25. Peru	6.687	2,118,616	-34,175	1,850.983
26. Philippines	3.280	13,270,653	-1,196,157	1,475.778
27. Sri Lanka	3.489	2,859,480	-92,784	710.0172
28. Suriname	3.940	163,410	42,975	3,619.626
29. Tanzania	1.964	640,189	-67,475	190.289
30. Thailand	2.609	26,057,000	7,336,663	878.126
31. United States	7.373	9,568,996	285,701	53,402.960
32. Uruguay	5.863	939,489	650,876	7,874.232
33. Vietnam	4.590	34,447,200	3,201,000	258.498

Note: (*) Year 2001 figures.
Source: United Nations (FAO); US Department of Agriculture; World Bank.

Figure 1 illustrates producer support in rice farming. It compares the level of support in terms of producer support estimates (PSE) in OECD and selected rice countries, between 1985 and 2002. For example, India has taxed its rice producers for

almost ten years (1988-1998) while the OECD countries have heavily subsidized their producers up to an average of 80% of the amount of value of output during 1985-2002.

Figure 1—PSE estimates for rice (%)



Source: OECD (2004); Mullen et al. (2004); Thomas and Orden (2004); and Mullen, Orden and Gulati (2005).

The levels of PSE's for OECD countries reflect high implicit export subsidies from the rich rice countries. OECD countries face artificially high domestic (producer and retail) prices and large surpluses because of the production support policy, declining per capita consumption, and increasing yield. Export subsidies and shipping rice as food aid have become necessary means to get rid of the surpluses. These distortions have contributed to lower world rice prices. On the contrary, figures on the developing

countries' PSE measures reflect taxation of rice farming and rice export in developing countries. In fact, developing countries with rice surpluses have taxed their export (quota or *ad valorem* tax) or procured rice for food security and self sufficiency purposes and in many cases to increase government rent. These taxations have reduced the competitiveness of rice export. It is only in recent years that governments in rice producing countries lifted the barriers and begun supporting their rice export.

Despite the Uruguay Round Agreement on Agriculture (URAA), governments in both developed and developing countries producing rice have maintained high levels of protection. Developed countries' reason for high tariff is primarily to protect their high cost rice farming and milling industries from the entry of cheaper rice, and to maintain their rice farming tradition. For developing countries, especially large producing and consuming nations, rice self-sufficiency and protection of domestic rice sector constitute the main motives for high protection. Rice protection policies, however, differ by variety, quality, degree of processing, and origin of rice. Overall, protection is far higher for *japonica* rice than for *Indica* rice. Wailes (2003) estimated that weighted rice tariff average is 217 % for *japonica* compared to 21 % for *indica*. The tariff for low quality grain rice is much higher than for high quality rice. Also, tariff escalation dominates the rice market as protection for milled rice is higher than for brown and paddy rice.

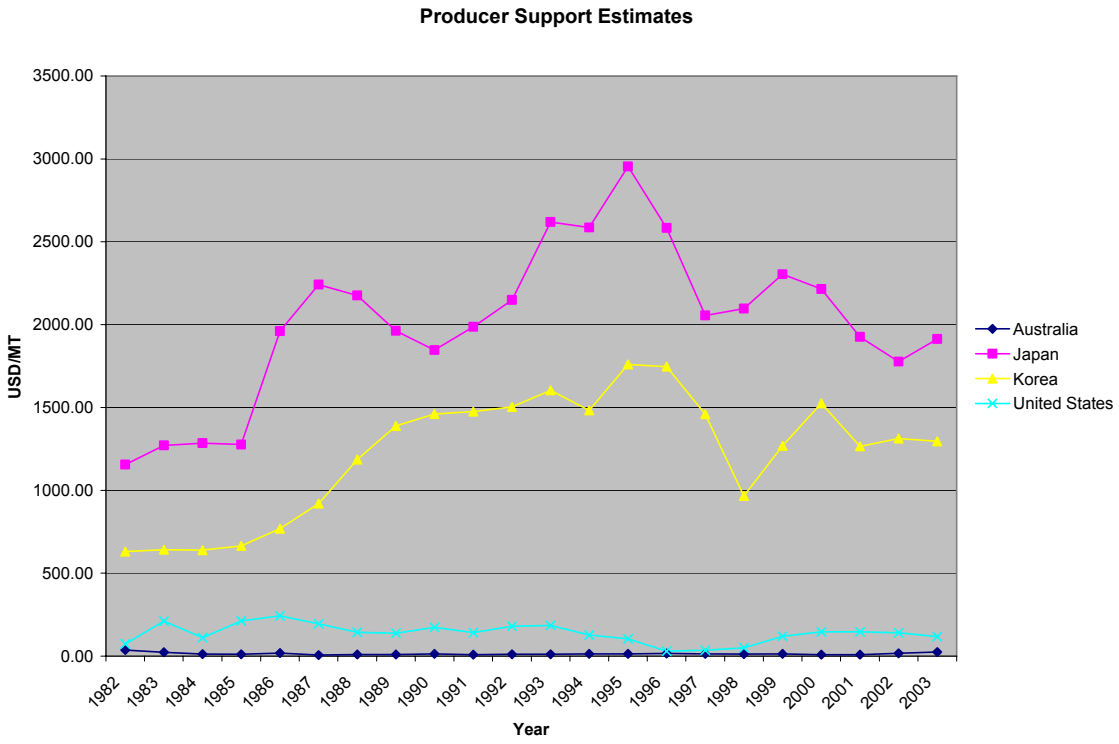
2.3 RICE POLICIES IN DEVELOPED COUNTRIES

This section outlines rice policies in high-income countries and the sources of policy distortions, especially in the European Union, Japan, Korea, and the United States.

Information used here comes mainly from the United States Department of Agriculture, Economic Research Service and Foreign Agricultural Service, and Wailes (2003). Specific information for individual countries also come from Fukuda, Dyck and Stout (2003) for Japan; Beghin, Bureau and Park (2003) and Sumner and Lee (2003) for Korea; Huang (2002) for Taiwan; and Childs (2003) for the United States. Specific producer support estimates are compiled from the USDA, OECD, Mullen et al. (2004), and Thomas and Orden (2004).

High levels of producer support and import protection have characterized rice policies in OECD countries. Figure 2 illustrates the levels of these distortions among individual countries, measured in terms of nominal producer support equivalent (PSE). The supports peaked just before 1995 and declined until 1997; but they slowly returned to high levels after 1998, especially in the US.. Moreover, high protection and tariff escalated on the importing side especially in Korea and Japan on short and medium grain rice.

Figure 2—PSE estimates in OECD countries (USD per MT)



Source: OECD (2005).

OECD Production Support Policies

In the **EU**, producer support amounts to 351 Euros per ton and includes intervention stocks to support paddy price and direct payment to farmers.

In **Japan**, total rice support costs taxpayers an equivalent of 2.8 billion US dollars (USD) per year as most of the support is in the form of import restrictions which raise the domestic price, implicitly taxing consumers. A producer price floor based on moving average past-prices is in place. As a result, producer price in Japan is ten times higher than that of other *japonica* rice produced in other countries such as China. Moreover,

consumer price in Japan is three times higher than that in the rest of the world. To avoid large surpluses, Japanese rice farmers receive payments to reduce their acreage under the Production Adjustment Promotion Program (PAPP). About 1 million ha of rice land have been 'diverted' so far under PAPP. Farmers participating in the Production Adjustment Promotion Program can also benefit from a price deficiency payment program which pays up to 80% of the difference between a seven-year moving average and actual prices.[3]

Since April 2004, a new reform policy, the 'Rice Policy Reform Law' has been implemented to divert rice production by limiting volume of production per prefecture. The government will give farmers who participate in the new program about 10% of their existing income.

In **Korea**, about 91% of total Aggregate Measure of Support (AMS), which amounts to 1268 billion Won (or about 1 billion USD) a year, is for rice alone. Price support policy in Korea involves direct government purchase of part of the production at a price 25% higher than market (domestic) price. Under URRA, government has reduced price and quantity of the government purchase. Although Korean government purchases of rice now represent only a small fraction of the total production, AMS remains large because domestic market price is much higher than the border price.

[3] The Government of Japan aims at changing the structure of rice production and improving efficiency of production by encouraging the move towards large-scale farming. But the reform faces the hurdle of strong social ties among farmers in rural communities (which will be broken once the farm is managed by a few individuals and some of the small farmers move out) and of smallholders' reluctance to sell their lands.

In the **U.S.**, a price support program is currently implemented in the form of marketing loan of about 143 US dollars (USD) per metric ton (MT) of paddy rice. Moreover, U.S. producers receive income support through two payment programs: a fixed decoupled direct payment and a decoupled counter-cyclical payment. The U.S government offers also contract payments to its farmers to reduce acreage. There are conservation programs that take land out of production along with financial help to install better practices of land conservation.. There has been little adjustment in the rice program as rice represents only a small fraction of agricultural activity; the U.S rice imports are 12 % of domestic consumption. Nominal rice PSE in the U.S is estimated at 120 USD per MT of milled rice in 2002.

Australia has the lowest level of producer support among the OECD countries. In 2002, nominal PSE is estimated at 17 USD per MT.

In **Taiwan,** government procurement to ensure food security has been limited to a smaller amount per hectare. Government purchase (26% of production between 1996 and 2000) is stocked and used to maintain price within certain ranges. In 2000, guaranteed price per MT was about seven times higher than f.o.b price (USD 981 vs. USD 144). Under the 'Riceland Diversion Program', more recently replaced by the 'Rice Paddy Utilization Adjustment Program, Taiwan started reducing support (which was 30-40% of AMS in 2001) to farmers and encouraged them to divert to other crops..

OECD Trade Policies

High tariff rates and limited quota on import, and high export subsidy characterize the trade policies of high-income developed countries producers of rice in OECD. These policies remain in place despite efforts to dismantle them and despite trade preference towards selected low-income countries.

The **EU** applies tariff escalation; tariff for milled rice import is, for instance, about 416 Euros per ton while that for paddy import is 211 Euros per MT. Tariffs on variety of rice such as brown *Basmati* from India and Pakistan were low and have been eliminated recently. Countries in the Africa Caribbean and Pacific (ACP) group and the EU's Overseas Countries and Territories (OCT) receive a quota of 110 thousand MT with little or no tariff. The EU subsidy expenditure for rice export, following the Uruguay Round has been limited to 37 million Euros per year. Moreover, export refunds are set to 133 thousand tons of milled rice per year.

Japan shifted from absolute quota to tariff rate quota in 1999. Quota is 0.682 million MT per year (7.2% of average consumption) including rice products and preparations. In-quota tariff is zero but over-quota is high, about 341 Yen per kg (about USD 2800 per MT), in 2001. Imported rice is purchased by the government and exported as food aid or sold to local food processors who use rice as an input. The government food agency holds the exclusive right to import rice and collects a margin of up to 2.41 Yen per kg (USD 200 per MT) when rice is sold. Japan imports only expensive and relatively high quality *Japonica* rice from Australia and US (California).

Rice imports to the **U.S.** are highly protected also. For instance, a tariff of 14 USD/MT is applied for milled rice,21 USD/MT for brown rice, and 18 USD/MT for paddy rice[4]. US exports account for 12% of global rice trade. An Export Credit Guarantee Program was implemented to help foreign importers deal with unfavorable treasury problem or exchange rate fluctuation and to ensure that the U.S exporters will be paid. The Export Enhancement Program was implemented only between 1986 and 1996, and it has not been reinstated.

In **Korea**, because rice production dominates Korean agriculture any trade measure related to agriculture affects rice sector. Korea does not export rice, but imports relatively low price and low quality of *Japonica* and *Indica* rice from China and India to maximize the difference between domestic price and international price and to fulfill its WTO engagement. Also, Korea avoids importing high quality *Japonica* rice (mainly produced in Australia, California, and northern China), which is far cheaper than domestically produced rice.

Korea had lifted also non-tariff barriers, but the tariff remains high. It is committed, however, to increase its minimum market access from 1% of consumption to 4 % by 2004. Korea shielded itself under the WTO provision to set an absolute quota rather than tariff-rate quota. (Only the absolute quota, not the tariff quota, determines the border price and affects the measure of agricultural support) Recently, a new agreement has been reached to double Korea's minimum access quota by 2014 at a 5% tariff rate; rice imports would be spilt between two sources: the large *japonica* exporters such as

[4] 75% of US import in rice mainly comes from India, Pakistan and Thailand

Australia, China, Thailand and the United States; and other exporters that Korea qualifies as most-favored-nations.

Since its accession to WTO in January 2002, **Taiwan** agreed to a minimum access of 144,720 MT per year at zero tariff, although a markup to import up to USD 740 per MT is allowed.

2.4. RICE POLICIES IN DEVELOPING COUNTRIES

Achieving food security and protecting domestic rice sector dictates major policies in developing countries. Many rice producing countries from the developing world have started to move away from taxing to supporting the domestic rice production.

Argentina

Argentina produces high quality long grain rice and was the second largest rice exporter, after Uruguay, in Latin America in 2002, exporting about 220 thousand MT tons of milled rice. There has been no specific support program for rice in Argentina. Since April 2002, the government of Argentina increased export taxes on grain to 20% in order to increase revenue and limit domestic price hike.

Bangladesh

Bangladesh is a large rice producer. In 2002, Bangladesh produced 38 million tons of paddy rice, exceeding Vietnam's production, and yet, it had to import 943 thousand MT of milled rice because of supply shocks. Rice trade liberalization started in

1994. Tariff rates have changed over the few years. In 2000, Bangladesh imposed a 5% import tax and raised it to 25% in 2001(in addition to mid-year duty of 10% which was later dropped, income tax of 3% and development surcharge of 2.5% was applied). Since 2003, the tariff rate has been 22.5 %. These have contributed to a high domestic price in comparison to the world price.

Brazil

Brazil has been the largest rice producer outside Asia. It produced more than 10 million MT of paddy rice in 2002. Brazil's rice production support amounted to a nominal PSE of 107 USD per MT in 1987. Brazil's rice market has been open with relatively little protection remaining. Imports come from the U.S and especially two of its neighbors, Argentina and Uruguay.

China

China, the largest world rice producer− producing 177 million MT of paddy rice in 2002 − taxed rice farming until 2000. The 1999 'New Price and Procurement Policy' eliminated government purchase. After 2000, support emerged and the nominal estimate of China's PSE in 2002 was about 5 USD/MT of milled rice. China's imported long grain rice and rice consumption there shows some changes towards high quality *Indica* rice as per capita income grows.

Also, in 2002, China negotiated a TRQ of 2.7 million MT (1.3 MT long grain and the rest for short grain) and imported long grain rice from Thailand. In 2003, TRQ was

2.25 million MT for long grain and 1.53 for short grain. Within quota tariff was 1% and over quota tariff reached 64% by 2004.

China exports its short grain rice to Russia, Japan, South Korea and its long grain rice to developing countries in Asia and Africa. China's exports are controlled by the state trading agency, China Food Corporation (COFCO).

Egypt

Egypt produces medium grain rice and has become the largest rice producing country in Africa and in the Middle East region. In 2002, production reached 5.6 million MT of paddy from which 463 thousand metric tons of milled rice was exported mostly to the Middle Eastern countries such as Jordan, Saudi Arabia, Syria, and United Arab Emirate. Egypt's tariff rate was lowered to 20 % in 2002.

India

India is the second largest rice producer, producing 108 million tons of paddy rice in 2002. Like China, India had persistently taxed rice farming until 2002 and 25 % of harvested crop was purchased for government stocks (grain procurement policy). Nominal PSE reached 78 USD per ton of milled rice in 2002. Moreover, export subsidy is estimated at 50% of procurement prices in 2001. India exports both high and low quality long grain rice. Although it was a net rice exporter in 2002, it still imports rice at high tariff rates which are 80% for brown rice and 70 % for milled rice.

Indonesia

Indonesia is a large rice producing and consuming country. Indonesia was the third largest rice producer in 2002 with 52 million tons of paddy produced[5]. In Indonesia, government stabilizes consumer and producer prices through the Badan Urusan Logistik, BULOG, which is a state trading enterprise. Indonesia is one of the few developing countries that have consistently supported rice farming. In 2002, for instance, nominal PSE in Indonesia reached 95 USD per MT.

Indonesia has become the world's largest rice importer, mostly of low quality long grain rice, because of its high per capita consumption and frequent adverse supply shocks. In 2002, it imported about 1.9 million MT of milled rice equivalent, three fourth of which came from Thailand, Vietnam, and India.[6] Indonesia imposes high protection on imports through the state trading BULOG. The quantitative import control lasted until 1998, the year when rice trade was liberalized only for a short period. However, government reinstated BULOG's monopoly power in 2000, after price floor could not be maintained.

In recent years, effective rate of protection in Indonesia was estimated at about 100 % and domestic price has been almost twice the border price. But important flow of rice smuggling tends to reduce the price difference.[7] Due to bumper crops, rice import

[5] Projection for 2004 was 54.3 MT.
[6] For brevity, we will refer to "milled rice equivalent" as "milled rice" since paddy trade is a small portion of the total.
[7] Current specific tariff is Rp430/kg, (the equivalent of a 30% tariff rate). Producer associations want to increase up to 36% tariff equivalent.

was banned since 2003/2004. The ban continues to be in effect; this could change, however, if the 2004 tsunami disaster lowered the stock of rice to a critical level.

Pakistan

Pakistan was the fifth largest rice exporter in 2002, exporting 1.7 million MT of both high and low quality long grain rice. Pakistan has no production support program in place. Rice export was liberalized since 1996 (Calpe, 2004).

The Rest of Latin America

Colombia and Peru produced 2.3 and 2.1 MT of rice paddy in 2002 and are among the largest rice producers in Latin America besides Brazil. They remain, however, net rice importers because of lack of infrastructure that handicapped rice distribution. Columbia and Peru imported 62 and 34 thousand MT, respectively, in 2002. Main supply sources are Uruguay, Argentina, and the U.S.

Philippines

The Philippines was the second largest rice importer, following Indonesia, importing 1.2 million MT of milled rice in 2002. The National Food Authority (NFA) has protected local producers from lower price (although they are more successful in

protecting rice ceiling than rice floor) by purchasing rice and releasing in the market to keep the price below an acceptable level for consumers.[8]

The NFA controlled rice import through quantitative restrictions until 2004; application of quantitative restrictions was only allowed to the Philippines, Japan, and Korea in 1995. Such restrictions put domestic retail price of low quality rice at 2.3 times higher than world price in 2001. Main import sources are the US, China, Thailand, Vietnam and Australia. Import consists mainly of low quality (more than 25% broken kernel) rice. Local variety is of higher quality. Import was projected to be around 0.7 million MT in 2004.

Madagascar

Producing 2.7 million MT of paddy rice in 2002, Madagascar has been for many years the second largest rice producer, after Nigeria, in Sub Saharan Africa. Because of internal supply shocks and high per capita consumption, Madagascar still imports rice. Rice import was about 61-100 thousand MT in 2002. Liberalization of rice trade started in the early 1990's, although government has maintained a buffer stock to mainly protect consumers from rising prices. Rice farming has been always taxed by a price ceiling for many decades. In 2004, because of a series of hurricanes flooding rice fields, domestic rice increased rapidly and the government of Madagascar encouraged rice import to dampen and stabilize retail price at Ariary 700,000 (equivalent of USD 350) per MT.

[8] Literature provides no PSE for the Philippines.

The government has relaxed import procedures and facilitated shipment and local distribution for local importers. Madagascar has no specific tariff left on rice.

Myanmar

Until the mid-60's Myanmar was the world's largest rice exporters, outpacing Thailand. Myanmar produced 23 million MT of paddy rice and ranked third (after Vietnam and Thailand) in 2002. But Myanmar's export was only 0.7 million MT of milled rice in 2003, most of it went to West Africa. Myanmar has a potential to expand production and export because its soils and climate are favorable to rice farming. Despite such comparative advantages, domestic problems, such as insecurity and lack of infrastructure impede Myanmar's expansion of rice production and export.

Nigeria

Nigeria is a large rice consuming and importing nation. In 2002, its import of nearly 1.2 million MT of milled rice was the second largest in the world. Nigeria's local production is highly protected by high tariff. Import was banned until 1994 and minimum import prices were imposed for tariff calculation purposes (Calpe, 2004). In recent years, Nigeria has applied tariff rates ranging between 50 and 100% depending on the origins and the type of rice. For instance, tariff rates on parboiled rice, mostly imported from the US reached 119 % in 2002/2003.

Thailand

Thailand is the world's largest exporter of rice, especially high quality and aromatic rice. It exported more than 7 million MT of milled rice in 2002. Thailand taxed its export until 1985 believing it had market power on the export market (Warr 2001). Thailand supports local producers through a loan program under the Bank for Agriculture and Agricultural Cooperative. Loan price was set at 95% of government target price which yielded approximately 10% price support in 2002. Government stocks increased through loan default. Because of the importance of rice export in the country's economy, Thailand's government still retains limited control on rice exports, although it has allowed a group of highly competitive local companies to expand Thailand's rice export.

Vietnam

Vietnam has emerged as the third largest rice exporter and producer, producing 35 millions MT of paddy rice, in 2002. Vietnam has no specific production or export support program ; it moved from imposing export quota, until late 1990's to supporting its rice farming. Nominal PSE in 2002 was 53 USD per MT. Rice export thrived, reaching 3.2 million MT of milled rice in 2002 but remains under government control and the state owned Vietnam Food Corporation (VINAFOOD).

Uruguay

Uruguay is the only country that exports more than two third of its rice production. Milled rice export reached 651 thousand MT in 2002. Along with Argentina, Uruguay is the largest rice exporter in Latin America, supplying Brazil and Peru. Uruguay has no specific production and export subsidy policy.

Other important players in the world rice market

Cuba imports about 400 thousand MT of rice per year from Vietnam and China. **Iran** is a large importer, importing about 1 million MT of milled rice in 2002. India, Thailand, and Vietnam are Iran's main suppliers.

Iraq has always been a major importer of long grain rice. In 2002, Iraq' rice import demand was estimated at 1.2 million MT, i.e. more than 4% of world import. Vietnam has been Iraq's primary traditional rice supplier. The lifting of the economic embargo with US led-invasion of Iraq has opened up Iraq's rice market of long grain rice to U.S rice farmers.

In recent years, **Russia'**s rice import fluctuated between 350 and 400 thousand MT per year of milled rice. In 2002, Russia imported 406 thousand from Vietnam (46%), China (32%), India (9%), and Thailand (8%). Russia's rice import consists mainly of high quality *indica* rice. Import tariff rate is 10%, but no less than a minimum tariff set at Euro 30 per MT. Russia has no import quota.

Countries in West Africa under the **West African Economic and Monetary Union** (UEMOA) include Côte d'Ivoire, Senegal, Guinea Bissau, Mali, Burkina Faso, Niger, Benin and Togo. These countries apply a Common External Tariff (TEC). Tariff rates are different for three main qualities of rice: 32 % tariff rate for broken 0-15% and for over 35 % broken rice; and 12% for 16-35% broken rice. These countries consume about 77% of medium quality rice (with 15-35 % broken kernels) and 22% for the low quality rice containing more than 35% broken kernel.

Côte d'Ivoire and Senegal, the largest rice importers in the UEMOA, imported 716 and 860 thousand MT in 2002. Import sources include Thailand, China, India, and Vietnam in 2002. Migration out of rural areas (due to political instability in Cote d'Ivoire) and unfavorable rainfall distribution reduced domestic production and increased import to keep up with the population growth.

2.5 MAIN ISSUES FOR THE WTO NEGOTIATIONS

One of the objectives of the URAA round in 1995 was to remove policy distortions in rice, but it produced little change in rice trade and policies. The Doha Round launched in 2001 has attempted to remedy the URAA limitations on three topics of the agreement: market access, domestic support, and export competition.

On Market Access

The URAA asked for tariffication and especially that the developing countries meet the 24% tax reduction and developed countries the 36% tax reduction by 2004.

Future negotiations would consider more tariff cuts on both sides based on the WTO formula, the Harbinson proposal. Such proposal asks for tariff reductions by 25-35 % in developing countries and 40-60 % in developed countries over a period of five years. For *indica* rice trade, there will be pressure for the importing countries in West Africa (such as Nigeria, Ghana, and Senegal) and Indonesia to lower their high and often prohibitive tariffs. Also, the role of the state trading enterprises in these countries will be discussed. But developing countries would continue to resist these cuts based on food security concerns and on protection of poor rice farmers from cheaper rice imports. Negotiations will focus on setting these bounds and whether some flexibility such as safeguards against currency fluctuation or rice dumping can be accepted.

On the other hand, pressure will continue for the developed countries to increase their minimum import quota and reduce the over-quota tariff, especially in Japan and Korea for short grain rice. Opening in the short/medium grain rice market will interest exporting countries such as Australia, China, Egypt and even the United States. Developing countries hope to follow the success of the negotiation on *basmati* rice, which can now enter tax-free the European Union.

On Domestic Support

The URAA limited subsidies to 5% of the value of production for developed countries and 10% for developing countries in the amber box. However, subsidies under the blue box that mostly include compensation from the 'set aside' policy have raised developing countries' concern. For developing countries, subsidies in the blue box are

just an extension of the amber box, which is an excuse to make distorting subsidies legal. Furthermore, recommendations to prevent developing countries from increasing their support to rice farming are likely to be challenged. Developing countries would likely ask for an increase in the support limits.

On Export Competition

Reducing and eliminating high levels of implicit and direct export subsidies in developed countries would continue to be central to the negotiation. Developing countries, except for a few such as India, Vietnam, and Thailand, are already prohibited from subsidizing rice exports. Also, developed countries would continue to debate among themselves on the elimination of the state trading enterprises that control rice import in Canada and New Zealand.

For many agricultural products including rice, developing countries will argue also for maintaining and extending the special and differential treatment (SDT) provisions in the WTO, especially in the face of erosion of preference. Protection of poorest farmers, economic stability, and food security concerns are the backbone of the arguments (FAO, Bureau et al. 2006). The SDT provisions embrace some flexibility on rules, such as postponing the deadline for compliance with SPSS regulations, limiting the tariff cuts, and maintaining certain levels of domestic support for developing countries. Whether these flexibilities intrude or not in the advancement of the WTO agenda remains debatable.

3. IMPACTS OF DISTORTIONS ON DEVELOPING COUNTRIES

3.1 ISSUES

The high degree of segmentation and market structure among different rice varieties, qualities, and forms imply that no uniform policy analysis applies to all these rice submarkets. Past studies on rice trade liberalization often faced the difficulty of disentangling the rice market mainly because of lack of data and of the differences in the number and characteristics of traders involved. However, a close look at the access and export competition in a specific rice market at a country level is needed to generate meaningful recommendations. The objective of this part of the study is to analyze the impact of a likely change in policies for three distinct rice markets, taking into account their structure. Specifically, the study examines (i) the import and export market of long grain milled rice in Latin America; (ii) the import market of ordinary white long grain rice in Indonesia; and (iii) the milled *japonica* rice market in Japan. A particular attention is paid to the market structure and interaction between trading countries that may use different strategies to increase their market shares or profits. The study provides illustrations of both, the impact developed countries' policies on developing countries and the impact of policies in some developing countries on other developing countries.

Tariffication and Rice Trade Liberalization for Rice Importers in Developing Countries

Many developing countries, especially those with poorest rice farmers, are currently importing rice. Removal or reduction of the high level of subsidy and

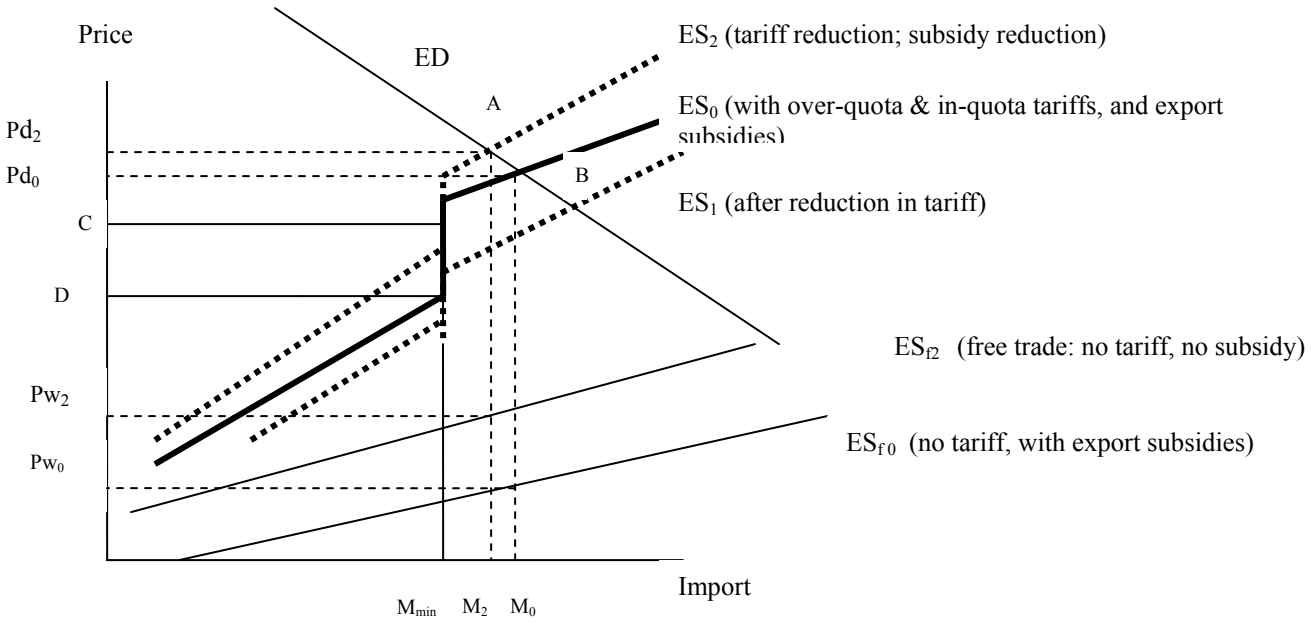
protection in OECD countries, and reduction of tariff and non-tariff barriers in rice importing countries are central to the negotiation on liberalizing rice market. Such reforms would lead to a world price increase that will benefit rice farmers and exporters in developing countries. But, tariff reduction in importing countries and subsidy reduction in exporting countries produce two opposing effects on domestic price and import volume. Tariff reduction will increase import volume and the world price, but it will reduce the domestic price. Reduction of subsidies in exporting countries will reduce trade volume, but it will increase domestic and world prices. Changes in domestic price and trade volume depend on which policy produces the largest effect and on the elasticity of the excess demand and that of excess supply. The outcome interests developing countries, such as Nigeria and Côte d'Ivoire and Indonesia, which apply high tariff and pursue price stabilization programs.[9]

Figure 3 depicts these policies under tariffication or tariff-rate quota (TRQ) framework (Moschini, 1991). It is assumed that import exceeds the minimum access, i.e. the over-quota tariff is binding, so that the excess demand curve (ED_0) intersects the upper part of the kinked excess supply curve (ES_0). Initially, with export subsidies on the exporting side and tariff on the importing side, trade volume is M_0, domestic price (in the importing country) is Pd_0 and world price is Pw_0. Tariff reduction will shift the excess supply curve down (to the left) from ES_0 to ES_1. Import and world price will expand but domestic market price will fall below Pd_0. A significant reduction in export subsidy will

[9] Since the level of protection in the long grain high quality rice market is relatively low, a significant reduction in subsidies will definitely have the most significant impacts on the high quality, long grain rice market.

shift the excess supply curve from ES_1 to ES_2. In this figure, the results of the two policies, compared with the starting scenario (where excess supply is ES_0), lead to an increase in the world price. However, what happens to import volume and domestic prices in the importing countries depends much on how significant the effect of reduction in export subsidies from the exporting side is in comparison with the effect of tariff reduction from the importing side. Only a significant reduction in export subsidy will lead to an increase in domestic price to Pd_2 and a fall in import volume to M_2, as the figure shows.

Figure 3—Tariff and subsidy reductions under TRQ model



The contraction in trade volume and, especially, the increase in the world price that follow the reduction or removal of subsidies in developed countries constitute an opportunity for other exporters from developing countries to expand their market shares. But, for rice producers and importers in the developing world the change in domestic price is important because of the tradeoff between protecting domestic consumers from price hike and keeping the farm price above a certain level set by the government.

Direction of the changes in the world and domestic prices remains the same in the case of unfilled quota (ED intersects ES at the lower kink of the ES curve). Reduction of tariff or subsidy does not provoke any change in price and import volume as long as ED intersects ES at a point in the vertical portion of the ES curve before and after the policy change. There are, however, a few exceptions. For instance, it is always possible that a reduction of tariff alone will turn an initially non-binding minimum access quota into binding as import volume expands. Also, the over-quota tariff combined with the minimum access rate puts a limit on how much the exporting country can spend on export subsidies. Subsidy level cannot be set above the over-quota tariff levels—(rigorously, ES_1 moves back only up to ES_0 after subsidy reduction).

Appendix A provides an algebraic explanation of these price changes, showing the two opposing effects of tariff and subsidy reductions. This framework provides a basic understanding of most of policy analysis and implications in the segmented rice market for rice importers in the developing world.

3.2 LONG GRAIN MILLED RICE TRADE IN LATIN AMERICA

The objective in this section is to measure the effects of the reduction (or removal) of producer subsidies in the OECD countries (mainly in the U.S), especially on world prices, and on importers and other exporters competing in the market for *indica* rice in Latin America. Since 75 % of rice traded in the international market is *indica* rice and 75% of rice traded is high quality rice, it is likely that at a higher percentage of rice traded in the international market falls under the category of high quality white milled *indica* rice. High quality *indica* rice is defined here as fully milled, non-parboiled, long grain rice, with low percentage of broken kernel (less than 20%). The usual references in this category include the '100 % Grade B' rice from Thailand, 5% broken kernel rice, also from Thailand, and the '4% number 2 from the U.S'.

Although large exporters such as Thailand, and more recently Vietnam have emerged as prominent exporters, the US remains the leading exporter of high quality long grain rice. In 2003, the US exported 934 thousand tons of long grain milled rice to Russia, Indonesia, Canada, Côte d'Ivoire, Ghana, Haiti, Latin America, and Philippines. The EU, Iran, and Iraq are also among the world's importers. Argentina and Uruguay are the main exporters in Latin America, mainly exporting to Brazil and Peru. For instance, Table 2 shows the destination of Uruguay's export in 1996.

Table 2—Uruguay milled rice exports by destination, 1996

Country	Metric Tons	Percentage
	(000's)	
Brazil	343,080	64.7
Peru	72,228	13.8
Senegal	50,898	9.6
Iran	39,562	7.4
Chile	10,734	2.0
Mexico	3,350	0.6

Source: Rice Sector Commission, El Pais Agropecuario, No. 15:17, 1996.

Protection in the importing countries for high quality long-grain rice market is much lower than in low quality long-grain market. Importers of high quality *indica* rice, such as Brazil and Russia have recently reduced their already low tariff levels. Iran, another importer, has practically no official tariff in place. However, the exporting side is characterized by high producer price support (especially from the U.S) which constitutes implicit export subsidies, along with direct export subsidies.

We examine the case of import markets of Brazil and Peru, the largest rice producers in Latin America. Table 3 shows levels of production and import in the America's in 2002, and the important place of the U.S export, especially to Canada, Haiti, Peru, and Mexico. Our goal is to determine how the reduction in subsidies on the U.S side will affect world prices and exports in these developing countries and on regional exporters such as Argentina and Uruguay.

Table 3—Milled rice production and imports in selected countries, 2002

	Production (1000 tons)	Total Import (1000 tons)	Import from the US	
			(1000 tons)	(% over total imports)
Brazil	7,050	1,117	347	31
Canada	n.a.	242	175	72
Chile	90	153	12	8
Haiti	65	345	339	98
Mexico*	185	582	582	100
Peru	1,597	32	22	69
Nicaragua	191	102	102	100

Source: US Department of Agriculture, Foreign Agriculture Service.
* 2001 figures for Mexico.

Brazil produced about 11 million MT of paddy rice (i.e. about 7.5 million MT of milled rice equivalent) in 2003, being the largest rice producer in Latin America (outpacing Uruguay at 1.2 million MT and Argentina at 0.71 million MT of paddy rice). Nevertheless, Brazil imported rice from the U.S and two of its neighbors, Argentina and Uruguay. In 1996, 65% of Uruguay's export went to Brazil. Brazil provides an appropriate case study because it is a large rice producer but has to import rice because of the open market policy. Table 4 shows that paddy price in Brazil is seven times higher than that in Argentina and Uruguay.

Table 4—Paddy price in selected countries, $/MT

Year	Argentina	Brazil	Peru	Uruguay	US
2000	116	701	166	106	124
2002	125	844	148	116	85

Source: FAO.

Peru is another large rice producer in Latin America with 2.2 million MT of paddy rice (about 1. 6 million MT of milled rice) in 2002. Lack of infrastructure impairing rice distribution limits consumers' access to domestic production. Peru has to import rice mainly from the U.S, Uruguay, and Argentina. Peru's milled rice imports equivalent, however, dropped from a yearly average of 246 thousand MT in 1995-1998 to 54 thousand MT in 1999-2002 (USDA).

Framework

a) Import demand (Excess demand):

Assume that excess demand Q_m is a function of import price (an index price) P_m, domestic price P_d and income I.

$$Q_m = f(P_m, P_d; I) \qquad (1a)$$

Assume that substitutability of rice from the U.S and non-U.S sources is imperfect, and that the residual import demand from a non-U.S source Q_n is a function of the following: the price of imported rice from the non-U.S source, P_n; the U.S price, P_{us}; and expenditure on rice import from the non-U.S source, I_n.

$$Q_n = Q_n(P_n, P_{us}, I_n) \qquad (1b)$$

b) Export supply

Using Goldstein and Khan (1978), export supply is a function of the ratio between domestic price (in the importing countries) and fob price P_{usf} and P_{nf} in the exporting

countries. Also, it is assumed that export supply is related to input cost *ICOST* and bilateral exchange rates *ER* between the traders.[10]

$$X_{us} = X_{us}(P_d/P_{usf},\ ICOST_{us},\ ER_{us}), \qquad (2a)$$

$$X_n = X_n(P_d/P_{nf},\ ICOST_n,\ ER_n) \qquad (2b)$$

c) *Identity: market clearing conditions*

$$Q_m = X_{us} + X_n\ ;. \qquad (3a)$$

$$Q_n = X_n\ ;\ and\ Q_{us} = X_{us} \qquad (3b)$$

Exports to Brazil increase as domestic prices rise relative to export prices from importing sources (mainly, the U.S, Uruguay, and Argentina) and as export capacity increases.

[10] A basic quantity leadership model provides insights on how suppliers in developing countries would react to a reduction of the price support in developed countries. It is assumed that the inverse of the excess demand function is P=aQ+Z, where a<0 is its slope and Z>0 is a demand shifter. The leader and follower export the amounts q1 and q2 (with Q=q1+q2). The groups 'marginal costs, c1 and c2, are assumed to be constant. The follower will choose q2 that maximizes its profit, taking q1 as given. The solution is the reaction function. Second, the leader will choose q1 to maximize its profit using the follower's reaction function. The results are as follows.

q1 = -(Z+c2-2c1)/2a (leader)
q2 = -(Z-3c2+2c1)/4a (follower)
P* = Z – (3Z/4 - c2/4 –c1/2) (equilibrium price)
Q* = q1+q2 = -(¾)(Z/a)+(1/4) (c2/a)+(1/2) (c1/a) (equilibrium quantity)

Because subsidies (especially input subsidies) often reduce the true cost that the subsidized-farmers should bear, farmer's marginal cost increases as subsidy is reduced, i.e., dc1/ds<0. Consequently, it can be shown that dq1/ds>0 and dq2/ds<0, that is, as subsidies decline, the leader's output declines while the follower's output increases. World price will increase as subsidies are reduced, dP*/ds <0. The overall quantity traded will be reduced as subsidies decline, dQ/ds*>0, because the decline of the leader's export is larger than the increase in the follower's export. We note that the outcome will be the same no matter where the reduction of subsidy comes from (the follower or the leader) as long as the reduction of subsidy raises production cost, i.e, shifting supply curve upward. If the exporters purchase input from the same input market, the impacts of the change in input cost on competitor's export volume and price is captured in the impacts of exchange rates.

Estimation and Results

The system of equations (1a) through (2b) is estimated simultaneously for Brazil and Peru between 1978 and 2002. Appendix B1 details the data employed and sources.

Table 5—Imports of milled rice in selected Latin American Countries (1978-2002): 3SLS estimates

Variable Dependent	**Brazil**	**Peru**
Import Demand		
Import Price	- 0.800 ***	-0.238*
	(-2.70)	(-1.70)
Domestic Price	0.803 ***	0.672
	(2.63)	(1.14)
Income	0.250	0.561
	(0.31)	(0.83)
Exchange rate (domestic per USD)	0.043	-0.565***
	(1.41)	(-3.62)
Import Demand from Non-US source		
Import Price	-0.045 ***	- 2.402*
	(-2.86)	(1.73)
US price	0.411	3.051**
	(0.89)	(2.15)
Expenditure Share	0.194	0.701***
	(0.22)	(5.63)
US Export Supply		
Ratio Domestic price/US price	2.234*	1.776*
	(1.70)	(1.91)
Input Cost	-1.896 ***	-1.137***
	(-9.94)	(-7.83)
Exchange Rates (domestic per USD)	-0.146*	-1.823 *
	(-2.27)	(-1.88)
Non-US Export Supply		
Ratio Domestic price/Uruguay Price	0.703 *	0.350***
	(1.70)	(6.61)
Input Cost	-1.125***	n.a
	(-20.21)	
Exchange Rates (domestic per Uruguay's peso)	-0.075***	-0.949
	(-4.17)	(-1.24)
N:	25	25
System-R-Square:	0.65	0.53

Note: Figures in parentheses are t-values.
Source: Author.

The results in Table 5 show that overall, Brazil milled rice import is relatively price inelastic. As expected, import increases as domestic price increases. Also Argentina and Uruguay have become important players in Brazil import market. Price elasticity of import from Uruguay and Argentina is relatively small, -0.045, but is statistically significant at 0.01 level. Export supply from non-U.S sources (Argentina and Uruguay) increases by 0.7 % as the ratio of domestic price for Brazilian rice increases relative to fob prices in these countries by one percent. The export supply elasticity with respect to the ratio of domestic price and the U.S fob price is 2.2 indicating that a reduction of the U.S export subsidy leading to an increase in the US fob price by one percent would reduce U.S export to Brazil by 2.2 percent. But an increase in input costs (removal of all forms of input subsidies) in the U.S rice farming will have a negative impact on U.S export supply. Likewise, depreciation of Brazil's Real relative to USD has reduced U.S export supply to Brazil.

Peru's rice import demand for Argentine and Uruguayan rice is highly elastic; the elasticity is - 2.4 and statistically significant. Moreover, Argentina and Uruguay rice supply to Peru increases by 0.35 % as the ratio of Peru's domestic price to Argentina and Uruguay fob price rises by one percent. On the other hand, an increase in the U.S fob price by one percent (because of, say, decrease in implicit or direct export subsidies) would reduce U.S export supply to Peru by 1.8 %. In recent years decline in Peru's Pesos with regard to its trading partners' currency, especially the USD would reduce the import of rice from these countries to Peru.

Implications

Regional suppliers, especially Uruguay and Argentina play an important role in rice export to Latin America. Although, in recent years, the shares of US rice export have declined in large markets such as Brazil and Peru (Childs, 2003), the U.S rice export still has significant influence on import demand, especially in Peru. Moreover, the United States still dominates import market in countries such as Haiti, Nicaragua, and Mexico. Reduction of the U.S subsidies can further alter its rice export in the region. Moreover, reduction of any form of subsidies on input would reduce the U.S export supply. The average of the total amber box spending for rice for 1999 and 2000 was about 213.5 million USD, which, for instance, under the Harbinson proposal would be reduced by 60% in five years. Such a reduction would lead to a high percentage increase in U.S fob price and will definitely benefit rice export from the two regional suppliers Argentina and Uruguay.

Rice market in Brazil is large and expanding. Brazil remains an attractive export destination as its domestic rice is produced at a higher cost than in neighboring countries. Although Brazil is considering multiplying its import sources, rice exporters in Asia face high transportation costs that prevent them from competing with Argentina and Uruguay. If the world price rises because of a reduction in the distortion in *indica* rice, Brazil's rice self-sufficiency and export expansion are possible. But, the competitiveness of Brazil's rice export would have to match the big comparative advantage of the regional suppliers such as Uruguay and Argentina and Asian exporters. The latter have had the export

capacity needed to conquer the large market of long grain rice in the Caribbean and Latin America.

3.3 LONG GRAIN MILLED RICE IMPORT TO INDONESIA

The objective in this section is to determine the effects on domestic and world prices of the distortions especially high level of protection (in the importing countries) in the market for low-quality (also called 'ordinary') long grain rice. We define the low quality *indica* as the milled long grain rice containing more than 20% high percentage of broken kernels. Major importers of low-quality long grain rice include Indonesia, the Philippines, Bangladesh, and African countries such as Senegal, Nigeria, Cote d'Ivoire, and Ghana. Major producers and exporters of low-quality long grain rice include Thailand, Vietnam, India, US, China and Pakistan.

For low-quality long grain rice market, distortions reside mostly in the high protection in low-income importing countries such as Indonesia, the Philippines and Nigeria that affect exports from their fellow developing countries such as Thailand and Vietnam. Importers of low-quality long grain rice impose high barriers (at least higher than for the high-quality long grain rice) to protect local producers of low-milling quality rice. For instance, in Indonesia, the largest rice importer, imports have been under the control of BULOG and are totally banned since 2003 because of an unusually high production.[11] The ban was expected to last beyond 2004. Likewise, tariff rate in Nigeria

[11] Sidik (2004) discusses more of Indonesia's trade policy.

is estimated at 120% in 2004. The Philippines through the National Food Authority also provides high protection to its domestic production.

Major exporters of the low-quality *indica* rice, with the exception of India and the US, currently apply little or relatively low levels of (actual and implicit) support. Exporters such as China, Thailand and Vietnam had even taxed their export and production in the past. For instance, export taxes in Thailand were high since the 1970's but had been gradually reduced until it was completely abolished in 1986. Likewise, Vietnam export quota had remained until 2000. Removal of export tax and tendencies to subsidize export has led to lower exporting price, threatening domestic production in the large importing countries such as Indonesia, and the Philippines.

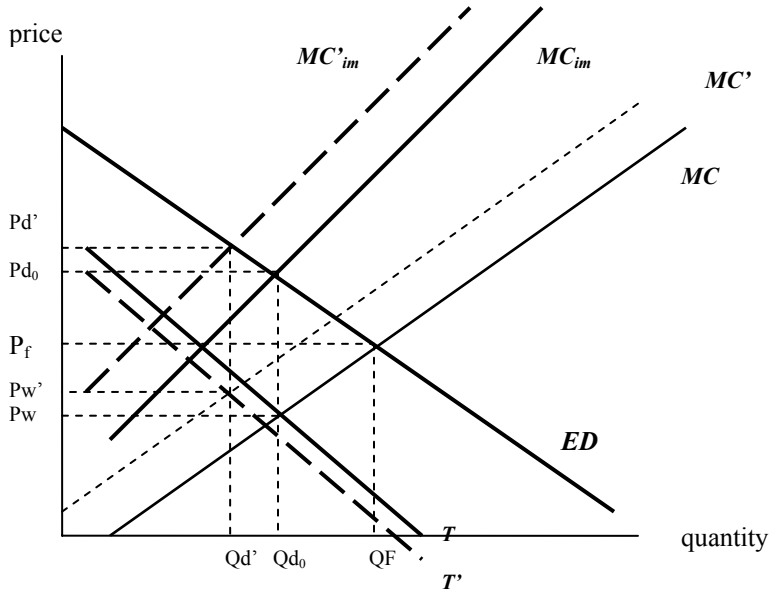
Framework

We assume that certain degrees of monopsony or oligopsony power prevail in the market for the low-quality milled *indica* rice. The reason is that large importing countries such as Bangladesh, and Philippines and especially Indonesia (as well as countries in Sub-Saharan Africa such as Cote d'Ivoire and Nigeria) employ state trading firm to control rice imports.

Figure 4 explains the various policies at work. Under free trade, Q_f amount of rice is imported at a price P_f per unit. Because of the upward sloping excess supply curve, the cost of importing an additional ton of rice must include the average cost per unit and the increase in marginal cost for the additional ton of imported rice. That is, the relevant marginal cost curve for the importer is MC_{im}. Because of its position as a large importer,

the import volume is reduced to Qd_0 and domestic price to Pd_0, at which importers cover all of its importing costs.

Figure 4—Optimal tariff model for state trading importers (adapted from Vousden, 1990)



To bring about such an outcome, the state trading importer imposes a tariff equals to (P_{d0}-P_w) that shifts the excess demand curve ED (which is also the import demand curve since exports in these large importing countries are relatively small) to *T* to restrict import at the desired amount Q_0. Exporters are paid P_w per unit and import price for the domestic market is kept at price P_{d0}. Hence, the state trading importer achieves two objectives: (i) protect domestic production by raising import price and limiting import volume, and (ii) cover import cost for each unit sold as it imports at lower price, but puts high values on the imported rice for its stock or sale. The monopsony power lies in the

government's ability to enforce import duties and choose import prices and volume that achieve these two objectives.

Tariff Response to Export Subsidy

We assume that negotiators agree on subsidy reduction, so that MC shifts to MC'. Reduction (increase) in subsidies would force state trading importer with a market power to reduce (increase) quantity imported and would increase (reduce) domestic and world prices. Tariff response still corresponds mostly to the two objectives which are to cover import costs and protect domestic production from low world price. But the direction of change in tariff to achieve the desirable domestic (importing) price is ambiguous and depends mostly on the elasticities of the excess demand and supply, and the extent of the subsidy reduction that triggers the shift.

On the one hand, reduction in subsidy would make the supply less price elastic and hence, could make the corresponding optimal tariff response higher than its level prior to the change. Figure 4 shows such an outcome in which the state trading importer would allow an increase in tariff to 'accommodate' the reduction in subsidy as the new relevant marginal cost curve is MC_{im}'. This seems counterintuitive but one reason is that the increase in world price will increase importing cost per unit; the importer could react by rising optimal tariff rate to cover its importing costs. Theory of 'managed trade' in Bagwell and Staiger (1990) offers another explanation which contends that when trade volume surges, importers raise protection to deter exporter's attempt to increase rent

seeking through higher export price, and hence to defect from trade agreement. Protection devices include raising tariffs and reducing import quota volumes.

On the other hand, subsidy reduction could lead into tariff reduction. As world price rises the importer feels that protection should not be too high so that tariff rate is reduced. This is especially the case if the state trading importer decides to achieve a desirable fixed domestic price by reducing its rent when world price rises. Besides, it might be also that reduction in the level of subsidy may not alter tax rate at all when current tax level still covers importing cost as both world and domestic prices increase at levels where the ratio between the two prices is unchanged.

Without prior knowledge of the extent of subsidy reduction, the elasticities of the excess demand and supply equation, it is difficult to predict how tariff would change as export subsidy declines. Moreover, beside the optimal tariff arguments, other reasons such as inventory management, food security or other political concerns could determine the change in tariff. Only empirical study will determine how tariff rate would change in response or independently to subsidy reduction. The challenge is to separate out the effects of optimal tariff from other reasons for maintaining high tariffs in order to predict how large importing countries would react to policy reforms in the world market.

Algebraic Solutions

First, the study solves algebraically for the market equilibrium conditions and then examine how the ratio between importing and world price changes. We name P the unit value of imports from the importer's view and P_w is the actual price (world price) at

which s/he imports rice. We assume that ρ accounts for the loss in handling or depreciation of rice quality between the time of purchasing and time of delivering the imported rice. We assume $P = \rho.Q_w$.

The importer's profit function is $\pi = P.(\rho.Q_w) - P_w Q_w$. Assuming ρ=1 and introduce an *ad valorem* tariff t on the demand side and subsidy rate s on the supply side, the linear demand and supply equations are:

$$P = (1+t)^{-1}\left[aQ + Z\right] \qquad \text{(import demand or excess demand)}$$

$$P_w = MC = (1+s)^{-1}[bQ_w + W], \quad \text{(excess supply)}$$

where P is price, Q import quantity, and W is a host of other marginal cost shifters (input or transportation costs). The large importer equates the perceived value of the marginal unit of rice imported to the actual world price plus the marginal cost accruing from importing the additional unit of rice.

(4) $P = P_w + P'_w Q$ which is the first-order condition (f.o.c)

or

$$P = (2bQ+W)\,(1+s)^{-1}$$

(It is further assumed that the second-order condition holds)

The solutions to the problem yields the following equilibrium domestic (importing) price and import volume

$$P^* = \frac{1}{(1+t)}\left(a\frac{Z(s+1)-W(1+t)}{2b(1+t)-a(1+s)} + Z\right) = \frac{1}{1+s}\left(2b\frac{Z(s+1)-W(1+t)}{2b(1+t)-a(1+s)} + W\right),$$

$$\text{and } Q^* = \frac{Z(1+s)-W(1+t)}{2b(1+t)-a(1+s)} \qquad (5)$$

Prior to the imposition of any tax, t equals zero in the above equations. However, the world price (at which the importer purchases rice in the international market) will be:

$$P_W^* = \frac{1}{(1+s)}\left[b\frac{Z(1+s)-W(1+t)}{b(1+t)-a(1+s)} + W \right] = \frac{1}{(1+t)}\left[a\frac{Z(1+s)-W(1+t)}{b(1+t)-a(1+s)} + Z \right] > 0 \text{ world price)} \qquad (6)$$

and the corresponding import quantity is

$$Q^* = \frac{Z(1+s)-W(1+t)}{b(1+t)-a(1+s)} \quad > 0 \qquad (7)$$

By taking the derivatives of the importing (domestic or after tariff) price *P** and world price (cif) with respect to *t* and *s*, it can be shown that both the reduction of tariff or subsidy in developed country will increase the world price as $dP_w/dt < 0$ and $dP_w/ds < 0$.

Also the domestic equilibrium price will decrease as tariff decreases, i.e. $dP^*/dt > 0$ but it will increase as subsidy decreases, i.e. $dP^*/ds < 0$. This leaves the impacts of the reform policies on the after-tax price ambiguous. The effects of the combination of the two policies will be certainly determined by which of the two derivatives has the stronger effects.

Market Integration, Degree of Distortion

We now focus on the ratio of the equilibrium domestic price to the cif import price, P/P_w. (We take out the star symbol to avoid crowding the notations.) This ratio is often used to determine how integrated and protected a market is compared to the rest of the world. We can write the f.o.c. in (4) as $P = P_w(1+\sigma)$, in which σ is the inverse of the price elasticity of the excess supply. σ contains various information such as the degree

of market power, the demand and supply shifters (income, input costs) in the importing countries as well as information on the rate of export subsidies on the exporting side. Because the average per unit tax t that importer imposes relates the two prices by $P=(1+t).P_w$, we obtain the familiar optimal tariff condition $t = \sigma$, i.e the optimal tariff rate being just the inverse of the excess supply elasticity. The concerns are whether the tariff is optimal (since there could be water in the tariff) and how the importer would alter tariff in response to the change in the level of subsidies.

Using (5) and (6), the ratio is

$$\frac{P}{P_w} = \left(\frac{2bZ - aW}{bZ - aW}\right)\left(\frac{b(1+t) - a(1+s)}{2b - a(1+s)}\right), \tag{8}$$

i.e., the price ratio is a function of the characteristic of excess demand and supply equations and especially levels of subsidies and tariff applied.

From (8), it can be proven that $d(P/P_w)/dt > 0$, i.e. tax reduction reduces price gap. Also, from equation (8) it can be shown that the sign of $d(P/P_w)/ds$ depends on the sign of $(1-t)$. For $t<1$ the price ratio will increase as subsidy increases: the world price decreases faster than import price. A reason is that the low cost of production and low output price from the subsidizing exporter entice a heightening of the protection measure in the importing country, hence, rising P/P_w. Likewise as subsidy is reduced, import poses less threat to domestic production in the importing country, which cuts protection, including its tariff rate in response.

But for high tariff (t>1) the ratio P/P_w would decrease as subsidy increases. This is more in line with the idea that subsidy increase would make the excess supply more elastic, that is, as subsidy increases, the inverse of the supply elasticity would decrease and optimal tariff response and P/P_w will also decrease. A decrease in export price due to the increase in subsidy still entice protection measure on the part of the large importer, but because the level of protection is relatively high, and that the importing cost is reduced, protection need not increase by much. Likewise, reduction in subsidy increases export price and the large importer reacts by rising tariff rate to cover the importing cost. This espouses the optimal tariff argument. The response however depends on the import demand and the excess supply elasticities, as well as variables such as the supply and demand shifters.

Econometric Model

Using (8) and a Taylor expansion of a non-linear relationship between tariff and subsidy[12], we propose the estimation of the following:

$$\frac{P_m}{P_w} = \alpha_0 + \alpha_1(ER) + \alpha_2(T) + \alpha_3(S) + \alpha_4(Z) + \alpha_5(W) + \varepsilon\,, \qquad (9a)$$

and

[12] To see the non-linear relationship, we assume that the ratio P*/P*w =(1+teq) where teq is a tax equivalent of an optimal tariff, by substitution in Equation (8) and solving for teq, we obtain the following (2bZ-aW)(b(1+teq)-a(1+s))=(1+teq) (bZ-aW)(2b-a(1+s)). Solving for teq yields:

$$t_{eq} = \frac{-aA(1+s)}{(2b-a(1+s))-Ab} - 1 \text{ where A = (2bZ-aW)/(bZ-aW)}$$

This expression of teq reveals a non-linear relationship between tariff equivalent and subsidy level which left undetermined the exact sign of response of change in subsidy on the optimal tax.

$$T = \beta_0 + \beta_\theta \theta + \beta_1 S + \beta_2 S^2 + \beta_3 INV + \varepsilon^{'}, \beta s > 0. \quad (9b)$$

ER is exchange rate, *T* is import tax, *S* is subsidy, *Z* is a demand shifter, and *W* is a supply shifter. The ε's represent error terms. The parameters θ and β*'s* indicate a departure from the optimal tariff implementation. Inventories are added, *INV* is defined as the difference between ending and beginning stock in (9a) to show that decision to change tax levels depends on levels of inventories. Prohibitive tax may follow high levels of stock following bumper crops.

Estimation and Results

The study applies the model on Indonesia's rice import. India, Thailand and Vietnam are the main suppliers of low quality *indica* rice to Indonesia. For instance, between January and June 2003, Indonesia imported 39% of its total rice import of low-quality rice from Vietnam and 37% from Thailand (World Bank). These two exporters have moved from taxing to lightly subsidizing their exports.[13] India's support for its producers has increased in recent years. Indonesia's import tariff remains high and becomes prohibitive since 2004, due to a bumper crop. Appendix B2 explains data and sources.

First we estimate the reduced forms in equations (6) and (7) on the equilibrium import price (cif) and import quantity simultaneously with the equation relating subsidy levels to tariff levels in (9b). We represent all variables in log form. The supply shifter

[13] Nielsen (2003) and Minot and Goletti (2000) offers more details on Vietnam's rice trade policy.

W represented by input cost is dropped fearing that it is correlated with the level of subsidy.

Table 6 reports the results of the estimation of the reduced forms. We note that:

Table 6—Reduced-form coefficients for Indonesia rice imports: Simultaneous estimation (1985-2002)

	Dependent Variables		
Independent Variables	**Import Price (cif)**	**Import quantity**	**Tariff**
Intercept	-0.106	-35.929**	6.748**
	(-0.06)	(-2.60)	(2.23)
Tariff	-0.122 ***	-0.426**	-
	(-5.22)	(-2.55)	
Subsidy	0.013	0.299	1.315*
	(0.20)	(0.61)	(1.94)
Income	1.387***	3.432	-
	(4.63)	(1.61)	
Food Price Index	-1.101***	1.021	-
	(-8.23)	(1.07)	
Inventory	-	-	0.131*
			(1.68)
N=18 ; System Weighted R-Square =0.94			

Note: All variables are in log forms. Figures in parentheses are t-values.
Sources: Author.

- High rice tariff in Indonesia is strongly and negatively correlated with (world) import prices and quantity, as expected: 10% tariff increase reduces import prices by 1.2% and especially depresses import volume by 4.3%.
- Exporter's subsidy (or taxation) has little influence on Indonesia's cif import price, which is a further sign of Indonesia's market power.
- There is a positive, although weak, correlation between subsidies and tariff. Increase in subsidy on the exporter's side will entice Indonesia to increase its protection through import tax. The positive and statistically significant coefficient on subsidy for the tariff equation indicates that part of the tariff rate is

implemented for reasons other than response to subsidies and inventory (for instance, to cover import cost)

- Income rise would increase consumption and rice import.
- As expected, the increase in inventory level will increase tariff rate.

Second, we estimate the parameters of the system of equation (9a) and (9b). Table 7 summarizes the result of the estimation using the linear and the double log-linear functional forms. The two results share similarities except for the effects of inventory and income. We mostly focus on the double log results. In both estimations on the price ratio model, we add time trends to account for the change in transportation costs and mark up.

Table 7—Explaining protection of Indonesia's rice import (1985-2002)

Variables	Level	Double log form
Dep. var: Ratio of domestic Price/cif world Price		
Exchange rate	0.0002*	0.232*
	(2.06)	(2.10)
Tariff	0.028***	0.115*
	(6.61)	(2.05)
Subsidy	-0.027**	-0.068
	(-5.35)	(-0.84)
Demand shifters (Income)	0.0001	-0.267
	(0.69)	(-0.67)
Supply shifter (Input Cost)		
Dep. var tariff		
Subsidy	3.660**	1.409*
	(2.22)	(2.13)
Subsidy square	0.030	n.a
	(1.09)	
Inventory	-430.314	0.134*
	(0.61)	(1.90)
N=	18	18
System Weighted R-Square =	0.76	0.87

Note: Domestic price means cif plus import duties. Figures in parentheses are t-values.
Source: Author.

The results show that the ratio of domestic (importing) price to world (cif) price P/P_w (which reflects both optimal tariff rates and other forms of protection—non-tariff barriers) certainly grew with the implicit tariff rates. The coefficient on tariff rate is positive and significant. In 2002, if the official implicit tariff rate were about 58% and the price ratio were 1.5, increase of tariff rate to 64% would have increased price ratio to 1.6.

The positive and significant impact of currency depreciation on the price ratio indicates the market power of the importer. A 10 % depreciation of currency, making rice import more expensive in local currency term, has been an opportunity to increase price ratio by 4.4%. This 'pricing to market' has been achieved by either raising P_d , i.e., taking profit from local consumers or lowering P_w , i.e. taking profit from the suppliers.

The impact of the increase in subsidy on price ratio P/P_w is mixed. Unlike the simple linear functional form, the double log form indicates no statistically significant correlation between export subsidy and price ratio. The negative sign seems inconsistent with the findings that a one percent increase in subsidy would be retaliated by a 1.4 % rise in tariff (from the price equation) and that tariff rates increase with the price ratio (from the price-ratio equation).

An explanation of the negative sign comes from previous section's analysis on the derivative $d(P/P_w)/ds$ that at high tariff rate, P/P_w may decline as subsidy increases. The ratio P/P_w contains information about all forms of protection as well as markups. As export subsidy increases and cif price falls, importer needs not to increase and may even reduce other forms of protection while maintaining the already high tariff rate, i.e. the

wholesale price fall is at least equal to the cif price fall. As a result, P/P_w which reflects level of various protections (not only tax) remains constant or falls.

The negative correlation between P/P_w and the level of subsidy finds also an explanation, as stated earlier, in the theory of 'managed trade' (Bagwell and Staiger, 1990). Indonesia's heightening of protection may have been a measure to deter its exporters' (mainly Vietnam and Thailand) attempt to increase their export taxes for rent seeking, especially during periods of high trade volume. Such a measure forces trading partners to stick to current terms of the agreement or at least to cooperate on a new one.

As expected, tariff rate increase is sensitive to the levels of inventory. Each 10 % increase in inventory per capita would cause an increase on the tariff rate by 1.5 %. This explains the banning of imports following a bumper crop in 2003-2004 that have raised the country's rice stock by 150%.

Implications

Optimal tariff, set to protect domestic sector and cover import cost, is not the only explanation of the difference between cif and domestic price for large importer such as Indonesia. Rent seeking (rise in markup) and government's concerns on food security and self-sufficiency are plausible explanations. However, an important finding in this study is that tariff hike is partly a response to the increasing (production and export) support on export side. An increase in subsidy on the exporter's side distorts trade in two ways. First, export subsidy dampens export price and other exporters' competitiveness.

Second, export subsidy entices large importers, such as Indonesia, to increase protection and tariff.

Indonesia's main suppliers, India, Thailand and Vietnam had recently stopped taxing their production and export. But Vietnam and especially India have started subsidizing export in recent years. Such an increase in subsidy, especially on export, may have already driven a large importer such as Indonesia to retaliate by setting high and often prohibitive tariff that would reduce import volume and distort trade further.

Application of the WTO proposal to cut the high bound rates of tariff on low-quality rice in large importing countries such as Indonesia, and Nigeria by 35 % would lead to lower applied tariff as these countries have had little or no 'water' left in their tariffs. But these importing countries would be more reluctant to reduce tariffs if exporters, including several developing countries, continue to subsidize their exports. The low-quality long grain rice market is among the cases where developing countries have to sort out distortions they create among themselves.

3.4 JAPAN'S MARKET OF MEDIUM/SHORT GRAIN RICE

The purpose of this section is to examine the likely impact of the reduction of production subsidies, tariff, and increase in minimum import (quota) in developed countries on the world price and trade volume for short and medium grain rice.

The highest levels of distortions in the world rice market reside in the market of medium/short grain rice. Protection and producer support are especially high in Japan, Korea, and to a lesser extent Taiwan, which are among the largest producing and

consuming countries. Between 2001 and 2003, per-year average producer support in Japan and Korea amounts 21 billion USD out of the 22.3 billion USD OECD's total producer support in rice.

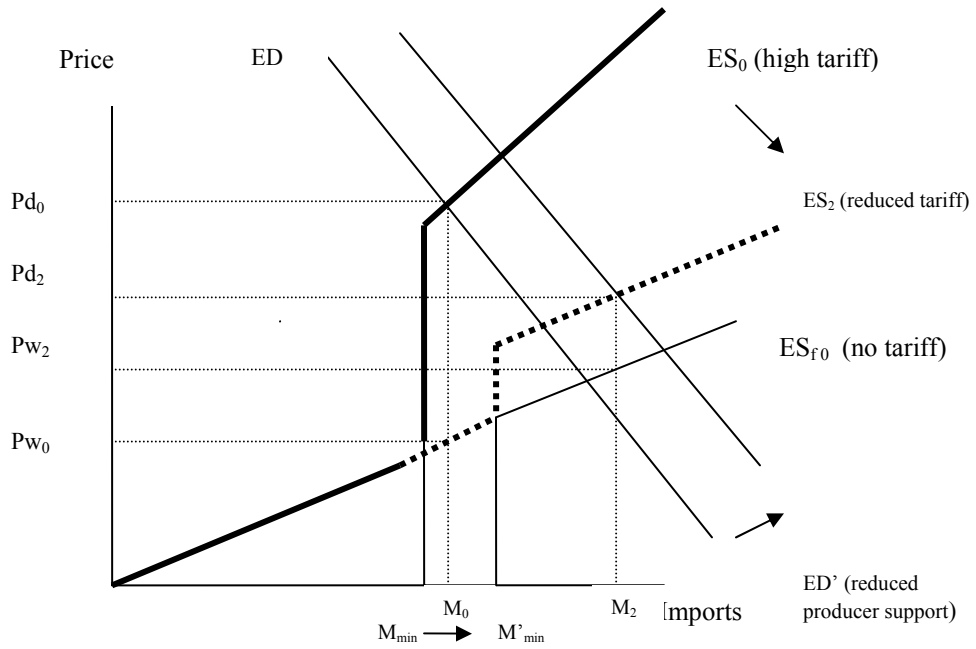
Supply of short/medium grain rice in the world market comes mainly from Australia (New South Wales), China (the central and northeast regions), Egypt, Italy, and the United States (California). For instance, the U.S produced 2.44 million metric tons in 2003, and exported 1.15 million metric tons, about half of the world trade in *Japonica* rice. Eastern Europe and former soviet countries such as Macedonia and Kazakhstan have also exported smaller amounts. Importers include Turkey, the EU, and countries in the Middle East (Israel, Lebanon, and Jordan) and Eastern Europe, (Ukraine, Russia, and Albania).

Policy change in Korea and Japan will have significant impact on prices and quantities in these countries. Further trade liberalization in medium/short grain rice market would continue to specifically call for an increase in minimum access and reductions of tariff and producer price supports in developed countries especially Japan and Korea.

Framework

Figure 5 depicts a basic TRQ model for Japan as a large producer with high level of production subsidies and high levels of import. That CIF import price is six times higher than producer price and eleven times higher than retail price, which reflects how high the protection level is in Japan.

Figure 5—Increase in minimum access, tariff reduction, and reduction of producer support



Both the increase in minimum access (shift from M_{min} to M_{min}') and a tariff reduction (shift from ES_0 to ES_2) will increase world price and dampen domestic price. Besides, reduction in producer support (shift from ED to ED') alone in the importing country will increase world and domestic prices. Overall, the combination of these policies increases world (or importing) price and import volume. The change in domestic price depends on how the effect of the reduction of domestic support matches the effects of tariff reduction and increase in minimum access.

This study proposes the following basic model:

Import price

$$P_d = P_m = P_w(1+t)$$

Excess demand (Japan)

$$\text{ED: } P_m(1+s) = aQ_m + Z$$

Excess supply (rest of the world)

$$\text{ESf: } P_s = b_f Q_s + W_f, \quad \text{(under free trade)}, \quad \text{for } Q_s < M_{min}$$

$$Q_s = M_{min} \quad \text{for } Q_s = M_{min}$$

$$\text{ES}_\text{v} \text{ (over quota excess supply) : } P_s(1+t)^{-1} = bQ_s + W_s \quad \text{for } Q_s > M_{min}$$

***Market clearing condition* (*equilibrium*)**

$$Q_m = Q_s$$

P_m and P_s are import and export prices. Price P_w is the world price; t and s are tariff and subsidy rates in percentage term.[14] Q_m and Q_s are the quantity imported and supplied. The Z's and W's are demand and supply shifters, other than tariff and subsidies. M_{min} is the import quota level.

Finding the equilibrium conditions

Finding equilibrium price and quantity (P_{meq}, Q_{meq}) involves four steps:

(i) Solving for $(P_{mv}, Q_{mv}) = \{\text{ES}_\text{v} \cap \text{ED}\}$

$$Q_{mv} = \frac{Z - W(1+s)(1+t)}{b(1+s)(1+t) - a} > 0, \; P_{mv} = \frac{(1+t)(bZ - aW)}{b(1+t)(1+s) - a} > 0; \qquad (10)$$

and as expected

[14] The subsidy rate s is the subsidy per unit of excess demand, not subsidy rate per unit of domestic production. Appendix B3 shows calculation on how reduction of domestic support is measured into an upward shift in excess demand.

$$\frac{dP_{mv}}{dt} = \frac{-a(bZ - aW)}{\left[b(1+s)(1+t) - a\right]^2} > 0 \text{ and } \frac{dP_{mv}}{ds} = \frac{-b(1+t)^2(bZ - aW)}{\left[b(1+s)(1+t) - a\right]^2} < 0.$$

And solving for $(P_{mf}, Q_{mf}) = \{ES_f \cap ED\}$

$$Q_{mf} = \frac{Z - W(1+s)}{b_f(1+s) - a} \text{ and } P_{mf} = \frac{bZ - aW_f}{b_f(1+s) - a} \ . \tag{11}$$

(ii) If the quota level is not binding, i.e., $Q_{mv} < M_{min}$ and $Q_{mf} \leq M_{min}$, then $Q_{meq} = Q_{mf}$ and $P_{meq} = P_{weq} = P_{mf}$.

(iii) If the quota level is binding, i.e., $Q_{mv} < M_{min}$ and $Q_{mf} > M_{min}$, then $Q_{meq} = M_{min}$; $P_{meq} = \{ED \cap (Q_m = M_{min})\}$; and $P_{weq} = \{ES_0 \cap (Q_m = M_{min})\}$

(iv) If the over-quota tariff is binding, i.e., $Q_{mv} \geq M_{min}$, then $Q_{meq} = Q_{mv}$, $P_{meq} = P_{mv}$,

and

$P_{weq} = \{ES_0 \cap (Q_s = Q_{mv})\} =$ and $P_w = b_f^*(Q_{mv}) + W_f$.

Application

For highly protected rice sectors in countries such as Korea and Japan, the minimum access is relatively small, and the case (iv) currently applies, i.e. import is (just) above the quota level (since imports include rice product equivalent.)

Based on (10), the initial quantity, domestic price, and world price are expressed in equilibrium as

$$Q_{eq} = \frac{Z - W(1+s)(1+t)}{b(1+s)(1+t) - a} > 0; \ P_{eq} = \frac{(1+t)(bZ - aW)}{b(1+t)(1+s) - a} > 0; \ P_w = b_f^*(Q_{eq}) + W_f. \tag{12}$$

The study attempts to determine the new equilibrium domestic and world prices and import volume P_{eq}', P_w', Q_{eq}' and measure the percentage changes.

(a) ***Increase in minimum access***:

scenario 1: $M_{min} < M_{min}' < Q_{eq}$,
then increase in minimum access does not have any effect on world & domestic price, nor on quantity traded.

scenario 2: $M_{min}' > Q_{eq}$,
then $P_{eq}' = a.\ M_{min}'/(1+s)+Z$;
$Q_{eq}' = M_{min}'$; and
$P_w' = b_f * (M_{min}') + W_f$.

(b) ***Tariff rate reduction***

As over-quota tariff is reduced from *t* to *t*', we just replace t by t' in the three expressions above and obtain: $Q_{eq}' > Q_{eq}$; $P_{eq}' < P_{eq}$; $P_w' > P_w$

(c) ***Subsidy reduction***

As producer support is reduced from *s* to *s'*, we just replace *s* by *s'* in (12) and obtain: $Q_{eq}' > Q_{eq}$; $P_{eq}' > P_{eq}$; and $P_w' > P_w$

Moreover, the parameters of the excess supply and demand functions are calculated based on the 2003 data and on estimates of elasticities from the literature reported in Table 8.

Table 8—Elasticities for short grain rice market

	Japan	S. Korea
Domestic demand elasiticty	-0.11	-0.02
Retail price transmission	0.40	0.17
Domestic supply elasticity	0.08	0.01
Producer price transmission	0.24	0.13
Import-demand elasticity	-2.98	-5.12
Income-elasticity of demand	-0.05	-0.25

Source: Cramer, Hansen and Wailes (1999)

Japan rice imports include rice products and preparations to justify that the minimum access required is attained.

Numerical applications based on the model are detailed in Appendix B1 through B3.

Increase in minimum import quota: Table 9 summarizes the results of the simulation on different rates of increase in minimum access based on 2003 figures. Japan's current over quota amount is only at 3.5% of its total import and the minimum access is 682,000 MT, that is, 7 % of consumption. An increase in minimum access below 3.5% will not change either the import (reference) price or the retail price in Japan. It will take more than 4 years before a yearly minimum increase of 0.8 % has a real impact on Japan's domestic and import prices.

Import price (P_w) rises rapidly as the rate of minimum access is expanded beyond the 3.5% threshold because Japanese import demand is highly price elastic. But the decrease in domestic price due to a more open import market results in modest drop on domestic price, which will, nevertheless, benefit the Japanese consumers.

For instance, assuming a 0.5 price elasticity of world's supply elasticity, 10% increase in minimum access, will rise import price by 14% and reduce domestic price by 2.1 %. Lower price elasticity of the world's excess supply, at 0.1, for instance, in short/medium rice will make the increase in import price and decrease in domestic price more significant.

Table 9—Increase in minimum access in Japan

	Year 2003	Increase in Minimum Access							
Minimum Access (MT)	682,000	3.5%	5%	10%	15%	3.5%	5%	10%	15%
Total Import [a] (MT)	706,065	0%	1.4%	6.3%	11.1%	0%	1.4%	6.3%	11.1%
In-quota									
Tariff (ad valorem)	0 %	0%	0%	0%	0%	0%	0%	0%	0%
Volume (MT)	682000								
Over-quota									
Tariff (specific,USD/MT)	580 -3100	-	-	-	-	-	-	-	-
Volume (MT)	22,707								
World Excess Supply Elasticity	-	0.5	0.5	0.5	0.5	0.1	0.1	0.1	0.1
Import Price (cif) (Pw) USD/MT	348	0%	2.9%	12.5%	22.2%	0%	14.3%	62.6%	110.9%
Retail Price (USD/MT)	3500								
Wholesale Price[b] (USD/MT)	1840-2000	0%	-0.5%	-2.1%	-3.7%	0%	-0.5%	-2.1%	-3.7%

Note: (a) Total import increase is relative to the total import in 2003. Total imports include rice products and preparations.

(b) It is the after tax price (equivalent to wholesale price for large importer)

Source: FAO, MAFF Japan; authors' computation.

Reduction of tariff rate: Average over quota tariff for rice in Japan was about 2700 USD/MT in 2003 but could reach 3100 USD/MT for processed rice products (such as rice flour) that were included as rice imports. Table 10 shows the results of the simulation for 2.5% and 5 % reduction of the over quota tariff rates per year until2008. Under both rates of tariff reduction, the impact on import price is more significant than for domestic price. Import price will grow significantly at about 21% and 44% per year under the 2.5% and 5 % decreases in over quota tariff. In contrast, domestic price will only drop by 0.7% and 1.2 % per year on average under the two scenarios.

Table 10—Reduction of over-quota tariff

Year	2.5 % reduction per year			5 % reduction per year		
	Import (1000 mt)	Import price (cif $/mt)	Average Wholesale Price ($/mt)	Import (1000 mt)	Import price (cif $/mt)	Average Wholesale Price ($/mt)
2003	706	418	2000	706	418	2000
2004	721	509	1986	737	600	1974
2005	737	620	1973	769	862	1948
2006	753	755	1961	803	1237	1922
2007	763	919	1948	837	1776	1897
2008	786	1120	1935	874	2550	1873

Source: Author.

Reduction of domestic support: Japan's total PSE on rice reached about 1900 USD/MT in 2003. Table 11 shows the effects of 5% and 10% yearly reduction in production subsidy in Japan. These results show that only aggressive reduction rates of producer support would have a significant impact on import price and volume. A ten percent reduction of producer support per year would increase import price by 3.3% per year.

Table 11—Effects of reduction of domestic subsidies per unit of production

Year	5 % reduction per year			10 % reduction per year		
	Import	Import price	Average Wholesale Price	Import	Import price	Average Wholesale Price
	1000 mt	cif $/mt	$/mt	1000 mt	cif $/mt	$/mt
2003	706	418	2000	706	418	2000
2004	709	424	2027	711	431	2054
2005	711	431	2054	717	444	2110
2006	714	438	2082	722	458	2167
2007	717	444	2110	727	472	2225
2008	719	452	2139	733	487	2285

Source: MAFF for 2003. Author's calculation for the remainder

Implications

Japan provides no signs of a sudden change in trade policy but these results show that increase in TRQ volume and large cuts in tariff and producer support would bring significant change in import prices and volumes of *Japonica* rice. The Harbinson proposal (WTO) suggests that minimum access should be increased to at least about 10% of consumption, over 5 years in a case like Japan where tariff rate quota is only 7% of consumption. This would increase tariff rate quota to about 974,000 MT, which is a 42% increase compared to 2003 tariff rate quota. If, for example, Japan follows the proposal, with 10% increase in minimum access per year, results show that such decision will significantly increase import price by more than 60%, which will be beneficial for exporting countries, especially those from developing world.

The over-quota tariff in Japan is at about 900%, and the Harbinson proposal would reduce it to 360% (reduction by 60%) of or at least to 405 % (i.e. reduction by the minimum of 45%), over five year period. If materialized, (i.e. with about 10% reduction tariff per year) such a proposal would increase import volume and import prices

significantly and beyond the impact of the 5% yearly increase exercised in Table 10. Even a relatively modest reduction of the over-quota tariff would have already a significant impact on import volume and price. This is because of the relatively high elasticity of import demand in Japan. Exporters in developing countries such as Egypt and China and transition economies in Eastern Europe would benefit from trade liberalization in the medium/short grain rice market.

Under the blue box, Japan rice expenditures amount to about 790 million USD, but the Harbinson formula would allow these spending to be included into the amber box. That will put Japan's import below the amber box limit. Thus, the proposal would have no effect on reducing Japan's support. However, if other propositions, for example, would lead to a decrease of these supports by 10% per year that would result in a significant increase in import price by about 16 % in 5 years, which would benefit exporters.

Low water supply for irrigation could, however, limit the expansion of rice production and export from important sources such as New South Wales (Australia) and northeast China (Childs, 2002) if the international market of the short/medium grain is liberalized. Full liberalization has to lead to significant increases in world prices, at least in the short-run, as world's excess supply elasticity remains low.

3.5 AROMATIC RICE

Aromatic rice includes Basmati rice from India and Pakistan, and especially fragrant rice from Thailand. The U.S produces aromatic rice called *texmati*, in reference

to the *basmati* variety, mostly for domestic consumption. Aromatic rice remains luxury rice even for high income consumers. Canada, EU, Jordan, Saudi Arabia, and the U.S are among the major importers of aromatic rice. Demand in aromatic rice has risen for the last 10 years because of rising income in importing countries.

Recently, India has exported about 950 thousand MT per year of *basmati* rice. The EU used to impose a reduced tariff on *basmati* rice imported from India and Pakistan. But since September 1st 2004, six out of several *basmati* varieties produced in India and two other varieties from Pakistan enter the EU duty-free. These varieties are 'Basmati 370', 'Basmati 386 Type-3' (Dehra Dun), 'Taraori Basmati' or (HBC-19), 'Basmati 217', 'Ranbir Basmati', 'Pusa Basmati', 'Kernel Basmati' and 'Super Basmati'. The EU requires a certificate of authenticity from DNA testing lab for its basmati rice imports. In 2003, India exported 140 thousand MT and Pakistan exported 40 thousand MT to the EU.

In addition, Thailand exported about 2 million MT of jasmine rice in 2003 and planned a 10% increase for 2004. New variety called the Pathum Thani produced and exported at lower price is already a boost to the expansion of Thai fragrant rice.

4. CONCLUSIONS

This study carried out a quantitative analysis of three aspects of the current and anticipated reform policies in rice trade. This analysis took into account high levels of differentiation in rice market and organization of three specific markets involved.

First, it was determined how the reduction in subsidies on the U.S side would affect prices and trade volume of long grain *indica* in regional markets in Latin America. The analysis of import market of long grain *indica* in Brazil and Peru showed that although the U.S market shares in these markets have declined in recent years, the US remains a significant import source. Reduction of the implicit export subsidies from high level of production support in the U.S would benefit regional suppliers such Argentina and Uruguay.

Second, the study examined Indonesia's import market to illustrate the effects on domestic and world prices of the high level of protection in importing countries and subsidies in exporting countries in the low-quality long grain rice market. It was found that despite the optimal tariff argument, tariff hikes in a large importing country such as Indonesia are in part a response to increases in export subsidies from the exporting side. Also, for a large importer such as Indonesia the level of stocks influences decisions to raise tariff.

Third, the study examined the likely impact on the world price and trade volume of an increase in minimum import (quota), and reduction of over-quota tariff and production subsidies in Japan for short and medium grain rice. This study found that

aggressive rates of increase in TRQ volume (above 3.5%) and reduction in production subsidies would have significant impact on the import volume and price. The reduction of domestic support and especially the high over-quota tariff, even at a small rate, would have a significant impact on import volume and price.

An analysis of these three specific rice markets shows that reducing production and export subsidies and protection in developed countries would benefit rice exporters from developing countries. Taking into account the segmentation of the rice market offered more insights in the policy interactions between trading partners. The case of the low-quality long grain rice, for instance, indicates that developing countries' own policies have also distorted trade among themselves, the so called 'south-south' trade. Such distortions need to be addressed along with those from developed countries during trade negotiation. Unraveling more the policy interaction in the rice trade is central to determining the sources and impact of all distortions and will help advance trade negotiations toward freer rice market.

APPENDIX

APPENDIX A
TARIFF AND EXPORT SUBSIDY REDUCTIONS WHEN OVER-QUOTA TARIFF IS BINDING

$P = [aQ + Z]$, a<0 (excess demand)

$P = \frac{(1+t)}{(1+s)}[bQ + W]$, b>0 (excess supply)

The equilibrium price and quantities are:

$$P^* = \frac{(bZ - aW)(1+t)}{b(1+t) - a(1+s)} > 0$$

$$Q^* = \frac{Z(1+s) - W(1+t)}{b(1+t) - a(1+s)} > 0$$

The change in domestic price as tariff and subsidy change:

$$\frac{dP^*}{dt} = \frac{-a(1+s)[bZ - aW]}{\left[b(1+t) - a(1+s)\right]^2} > 0, \text{ since } a < 0.$$

$$\frac{dP^*}{ds} = \frac{a(1+t)(bZ - aW)]}{\left[b(1+t) - a(1+s)\right]^2} < 0.$$

APPENDIX B1
DATA ON BRAZIL AND PERU IMPORT MARKETS

Pm , Pn, Pus = Import Prices indexes (cif unit values) for total import, import from non-US sources and from the US; USD/MT (FAO)

Pd = Domestic Price, USD/MT (FAO, USDA)

Pusf, Pnf = Export Prices (fob) for US and Uruguay (FAO USDA)

Qm, Qn, Qus = Import volumes in MT divided by total population, for total import, import from non-US sources and from the US (FAO and USDA)

I = Income: GDP constant 1995 USD per person (World Bank)

In = Expenditure on rice import from non-US sources (FAO)

ER = Nominal exchange rates in Brazil Real and Peru Pesos divided by nominal exchange rate of trading partners which are the US and Uruguay (for non-US sources); (World Bank).

ICOST = Input cost or price of agricultural and farm equipment: US Price index of agricultural and farm equipment index of price of farm equipment (US Department of Commerce).

APPENDIX B2
DATA ON INDONESIA RICE IMPORT MODEL

Pm = Indonesia wholesale price in USD/MT of ordinary rice, (FAO)

Pw = Indonesia import price in USD/MT: import value divided by import volume; (FAO)

ER = Exchange rates: Indonesia's Rupiah per USD (World Bank)

T = Indonesia implicit tariff rate (net protection rate %); Thomas and Orden (2004)

S = Export Support Index: producer nominal protection coefficient for Vietnam; (Mullen and Orden et al. 2004; Nguyen and Grote, 2004)

Z = Income: GDP per person constant USD 1995; World Bank

INV = Inventory (MT per person): Ending stock –Initial stock, USDA
Food price index = Indonesia's food price index, World Bank

APPENDIX B3
JAPANESE RICE IMPORT MARKET

Setting parameter values

We use the following values from Cramer, Hansen, and Wailes (2003): domestic price elasticity of demand = -0.11; domestic price supply elasticity = 0.08; import demand elasticity = -2.98; and income elasticity = -0.05.

Following the basic linear form of the excess demand and supply equations, the parameters are calculated as follows:

a = Slope of the inverse import demand function= (Import Price 2003) / ((import demand elasticity) x (Import Quantity 2003))

b = Slope of the inverse excess supply function = (Export Price 2003)/ ((excess supply elasticity) x (Import Quantity 2003))

Z = Import demand shifter

W = Excess supply shifter

a_d = Slope of the domestic demand function = (domestic demand elasticity) x (Domestic price) 2003/(consumption 2003)

a_s = Slope of the domestic supply function =(domestic supply elasticity) x (Domestic price 2003)/(consumption 2003)

Z and *W* are obtained solving simultaneously the excess demand and supply equations for the base year 2003.

We employed 2002/2003 data and set over-quota tariff t_0 = 3600 USD/MT, on subsidy s_0=1500USD/MT. We set wholesale price (price after tax) which is a proxy for domestic wholesale price at P_0 = 2000 USD/MT; import volume at Q_0 = 706065 MT; and

import cif price Pw_0 = 418 USD/MT; domestic consumption is about 9,750,000 MT, and consumer price is about 2500 USD/MT.

We calculated also the direct impact of subsidy s and tariff on import price and volume in elasticity terms:

$(dQ/Q)/(dt/t) = (-1/(b-a) \cdot (t_0)/(Q_0)$

$(dQ/Q)/(ds/s) = (-1/(b-a) \cdot (-a_d/(a_s-a_d)) \cdot (s_0)/(Q_0)$

$(dP/P)/(dt/t) = (-a/(b-a)) \cdot (t_0)/(P_0)$

$(dP/P)/(ds/s) = (-b/b(b-a)) \cdot (-a_d/(a_s-a_d)) \cdot (s_0)/(P_0)$

$(dPw/Pw)/(dt/t) = (-b_f/(b-a)) \cdot (t_0)/(Pw_0)$

$(dPw/Pw)/(ds/s) = (-b_f/(b-a) \cdot (-a_d/(a_s-a_d)) \cdot (s_0)/(Pw_0)$,

with b_f = Slope of supply curve under free trade = $(Pw/Q_0)/$(Excess supply elasticity).

We assume excess supply elasticity is 0.1.

Increase in minimum access:

Change in import cif price = % change in import/export supply elasticity

Change in wholesale price = % change in import/import demand elasticity

Reduction of over quota tariff by t_%

Import volume (MT) $= Q_0 (1+ (-t\_\% \times (dQ/Q)/(dt/t))^n$, n= 0, 1, 2.. is period

Import cif price (USD/MT) $= Pw_0 (1+ (-t\_\% \times (dPw/Pw)/(dt/t))^n$

Average wholesale price (USD/MT) $= P_0 (1+ (-t\_\% \times (dP/P)/(dt/t))^n$

Reduction of domestic support by s_%

Import volume (MT) $= Q_0 (1+ (-s\_\% \times (dQ/Q)/(ds/s))^n$, where n= 0, 1, 2.. is period

Import cif price (USD/MT) $= Pw_0 (1+ (-s\_\% \times (dPw/Pw)/(ds/s))^n$

Average wholesale price (USD/MT) $= P_0 (1+ (-s\_\% \times (dP/P)/(ds/s))^n$

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